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NOTES ON THE FLORA OF FIJI [1/]

Albert C. Smith [2/]

This opportunity is taken for a partial report on progress of studies of the flora of Fiji which I have been intermittently conducting for more than 30 years. The reasons why I have not yet produced the definitive book on the subject are doubtless obvious to any teacher or administrator whose research time is limited. However, progress for the last year or two has been such that I am now assembling a manuscript and can see that completion is a possibility.

One should indeed be somewhat diffident about conducting such an extended project in a part of the world that has its own capabilities, and in which one is a periodic foreign visitor. But in 1933, when I first visited Fiji, no other botanists were intensively interested in the flora, and various museums of the United States were extending their studies in the Pacific. At that time there was perhaps an excuse for a North American to undertake a long-term exploration of Fiji and the preparation of a Flora. The situation has now changed, and Fiji has its own reference collections of plants in the Departments of Agriculture and Forestry. It has also had the services of two interested botanists, B. E. V. Parham and John W. Parham, and of many capable local assistants, and now it has a published check-list of what plants are known to occur in Fiji (3). My task is thus made easier, and I am seeking to enlarge that publication by adding full descriptions, citation of specimens, bibliographic details, and keys to facilitate indentification - in effect to supplement Seemann's excellent

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1/ Abstracted from a lecture, "Fiji Revisited," presented at the December 11, 1967, meeting of the Hawaiian Botanical Society.

2/ Wilder Professor of Botany, University of Hawaii, and retiring President, Hawaiian Botanical Society.

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but outdated Flora Vitiensis (4) by a modern work. The existing collections of Fijian plants are not only in Suva, but also in England--at the Royal Botanic Gardens at Kew and the British Museum--and in several U. S. institutions, notably the Smithsonian Institution, Harvard, the New York Botanical Garden, and the Bernice P. Bishop Museum. In the course of time I propose to complete study of all these collections and to incorporate such records into my manuscript.

To this audience I am certainly not required to justify this type of scientific work. On the practical level, of course, an inventory of the plants of an area is basic to a knowledge of its natural resources related to agriculture, forestry, medicinal plants, ornamentals, etc. While such a practical goal is not mine, I nevertheless assume that applied scientists and others will find the eventual publication useful. From a different viewpoint, any such floristic study adds to our fund of basic knowledge that supports theories of plant distribution. Science requires such data from all parts of the world, and especially from tropical regions. The scientist who attempts to understand and explain the distribution of organisms and their evolutionary history and mechanisms needs no justification; he is adding something to the sum-total of human culture. That basic scientific research is often highly useful and practical as a by-product, and one can never predict how and when such research will prove of value in any but a cultural sense.

In general the plants of a region fall into three groups in reference to their establishment. The first consists of the indigenous plants - those occurring naturally and presumably established long before the arrival of man. Many of these indigenous plants occur nowhere else in the world; these are the endemic plants, which often provide the botanist with the most satisfactory material for conclusions as to evolutionary history and routes of migration. A study of only the indigenous plants of Fiji would, for this region, answer the questions botanists ask about evolutionary and migrational history. A second group consists of the adventive plants - plants that are now established and compete with the native flora, but that were introduced by man either intentionally or unintentionally. Third we have the plants that occur only in cultivation; these are the ornamental plants, the agricultural plants, etc., that presumably would disappear if man did not continually tend them. A Flora of a region, of course, must deal with the indigenous plants; but to be fully useful it should also incorporate discussions of the adventive and the cultivated flora, although such incorporation greatly complicates its preparation.

Table 1 will give an idea of the scope of the problem. While further study will cause revision of these figures, they are approximately correct. One sees that, if only the native, indigenous seed plants are studied, there are some 1,280 species involved (infra-specific categories are not under discussion at the moment). This figure may well rise to 1,400 or more when field studies and revisions are completed. Incidentally, about 68% of these species are endemic to Fiji. The indigenous seed plants fall into approximately 445 genera and 119 plant families. If one adds the naturalized, adventive plants, one has to consider an additional 492 species, and this introduces an entirely different 245 genera. If the cultivated plants are added, another 243 species have been so recorded (although this is surely too low a figure), involving an additional 132 genera. In another way, this is to say that adding the naturalized and cultivated plants increases my task by about 40%. At the level of genus the complications are essentially doubled, as the native flora is basically simpler in its botanical composition than are the adventive and cultivated floras, which come from all parts of the world.

We can demonstrate (in Table 2) the problem of coverage in a different way by looking at figures for the largest families of seed plants in Fiji. (incidentally, my remarks deal only with the angiosperms and gymnosperms; the ferns and other cryptogams I must leave for specialists to study.) Our largest family is the Rubiaceae, which has a total of 174 species distributed in 41 genera. These are nearly all native species and genera, and most of the species are endemic. At the other extreme, the grass and legume families have comparatively few native plants in Fiji, but their adventive and cultivated elements are extensive and also very complex. Other families summarized further illustrate the problems.

A comparison (Table 3) of the indigenous floras of Fiji and Hawaii is interesting. These areas, approximately the same in land area, probably have indigenous floras of about the same size. Figures for Hawaii are taken from Fosberg's valuable paper of 1948 (2), although an upward revision at the generic level has been indicated by van Balgooy (1). For statistical purposes Fosberg combined species and varieties, but one may estimate the number of indigenous spermatophyte species in Hawaii as probably between 1,000 and 1,200. But what is especially interesting is that Hawaii has only half as many genera as Fiji, and these genera fall into a greatly reduced number of families. These figures provide us with a comparison between a harmonic and a disharmonic flora.

Fiji retains an essentially harmonic flora, such as is characteristic of continental land areas. That is, the basic floristic elements are those to have been anticipated if the archipelago had been a fringing part of a much larger land mass. It has been noted (5) that nearly 23% of the spermatophyte genera with indigenous species in Fiji extend no farther eastward. On the contrary, truly oceanic archipelagoes like Hawaii have strongly disharmonic floras, in which the number of basic floristic elements is greatly reduced. A disharmonic biota lacks some elements because of their poor dispersal capacity. In general, the more remote an archipelago is from major land masses, and the more extreme its isolation, the more disharmonic its biota. The ancestors of the plants and animals of such an archipelago arrived there largely by chance dispersal, by a so-called "sweepstakes" route. Upon arrival they found many ecological niches unoccupied and so radiated in bursts of evolutionary activity. A disharmonic biota often has a much higher percentage of specific and generic endemism than a harmonic biota, even though basically (in number of ancestral elements) it is comparatively impoverished.

In continuation, the speaker showed kodachromes of Fijian plants, discussing changes in the landscape and vegetation that he had noted over a period of successive visits.

REFERENCES

1. Balgooy, M. M. J. van. Preliminary plant-geographical analysis of the Pacific. Blumea 10: 385 - 430. 1960.

2. Fosberg, F. R. Derivation of the flora of the Hawaiian Islands. In: Zimmerman, E. C. Insects of Hawaii 1: 107 - 119. 1948.

3. Parham, J. W. Plants of the Fiji Islands. 353 pp. Suva, 1964.

4. Seemann, B. Flora Vitiensis. 453 pp. London, 1865 - 1873.

5. Smith, A. C. Phanerogam genera with distributions terminating in Fiji. J. Arnold Arb. 36: 273 - 292. 1955.

Table 1

SPERMATOPHYTE FLORA OF FIJI

FAMILIES	155		
WITH INDIGENOUS GENERA		119	
WITH ONLY NATURALIZED OR CULTIVATED GENERA		36	
GENERA	822		
WITH INDIGENOUS SPECIES		445	(54%)
(INCL. ENDEMIC GENERA)		(11)	(2.5%)
NATURALIZED (or NAT. and CULT.)		245	
IN CULTIVATION ONLY		132	
SPECIES	2,015		
INDIGENOUS		1,280	(63.5%)
(INCL. ENDEMIC)		(872)	(68.1%)
NATURALIZED (or NAT. and CULT.)		492	
IN CULTIVATION ONLY		243	

Table 2

LARGEST SPERMATOPHYTE FAMILIES OF FIJI

FAMILIES	NUMBER OF GENERA				NUMBER OF SPECIES			
	T	I (E)	N	C	T	I (E)	N	C
RUBIACEAE	41	37 (5)	2	2	174	161 (136)	5	8
GRAMINEAE	70	17	52	1	171	28 (9)	142	1
LEGUMINOSAE	75	23	38	14	155	39 (16)	80	36
ORCHIDACEAE	40	39		1	122	119 (67)		3
EUPHORBIACEAE	27	20	5	2	90	68 (54)	16	6
PALMAE	20	11 (4)		9	49	35 (33)		14
MYRTACEAE	12	8	2	2	48	36 (26)	8	4
CYPERACEAE	14	12	2		46	24 (4)	22	
COMPOSITAE	34	6	27	1	41	6 (1)	34	1
PIPERACEAE	2	2			39	35 (30)	1	3
LAURACEAE	6	5		1	38	36 (34)	1	1
GESNERIACEAE	1	1			36	36 (34)		
MYRSINACEAE	6	6			35	35 (31)		

T = total; I = indigenous (including E= endemic); N = naturalized;

C = cultivated

Table 3

COMPARISON BETWEEN INDIGENOUS SPERMATOPHYTE FLORAS

OF FIJI AND HAWAII

	FIJI	HAWAII
FAMILIES	119	83
GENERA	445	216
(INCL. ENDEMIC)	11	28
% of GENERIC ENDEMISM	2.5 %	13 %
SPECIES	1,280	1,729 (+ vars.)
(INCL. ENDEMIC)	872	1,633 (+ vars.)
% of SPECIFIC ENDEMISM	68.1 %	94.4 % (+ vars.)

RECENT PACIFIC PUBLICATIONS

ANDERSON, W. R. & M. R. CROSBY. 1966. A revision of the Hawaiian species of Elaphoglossum. Brittonia 18: 380-397.

AWADA, MINORU. 1967. Effects of defoliation and defloration on sex expression and growth of papaya (Carica papaya L.). Proc. Am. Soc. Hort. Sci. 90: 138-143.

CARLQUIST, SHERWIN. 1967. The biota of long-distance dispersal. V. Plant dispersal to Pacific Islands. Bull. Torrey Bot. Club 94: 129-162.

CARPENTER, STANLEY B. 1967. Brush-killer stimulates adventitious rooting of tropical ash in Hawaii. Jour. Forestry 65: 421.

CLEMENTS, HARRY F. 1967. Effects of silicate on the growth and leaf freckle of sugarcane in Hawaii. 12th Congress, International Soc. Sugar Cane Technologists, Puerto Rico, 1965: 197-215.

CLEMENTS, HARRY F. & MINORU AWADA. 1967. Experiments on the artificial induction of flowering in sugarcane. 12th Congress, International Soc. Sugar Cane Technologists, Puerto Rico, 1965: 795-812.

CLEMENTS, HARRY F. & SHIGERU NAKATA. 1967. Minimum temperatures for sugar cane germination. 12th Congress, International Soc. Sugar Cane Technologists, Puerto Rico, 1965: 554-560.

DEGENER, OTTO & ISA GEGENER. 1967. Scaevola Gaudichaudiana & S. mollis. Phytologia 15: 160-162.

DEGENER, OTTO, ISA DEGENER, & WILLIAM MAC KENZIE. 1967. Lichen-covered electric wires in Hawaii. Garden Jour. 17:162-163.

DOTY, MAXWELL S. 1967. Contrast between the pioneer populating process on land and shore. Bull. So. Calif. Acad. Sci. 66:175-194.

DOTY, M. S. 1967. Pioneer intertidal population and related general vertical distribution of marine algae in Hawaii. Blumea 15: 95-105.

HONDA, NOBUO, WESLEY C. H. WONG, JR., & ROBERT E. NELSON. 1967. Plantation timber on the Island of Kauai, 1965. U. S. Forest Service, Res. Bull. PSW-6, 34 pp.

NAKATA, SHIGERU. 1967. Radioautographic study of translocation in bean leaves. Amer. Jour. Bot. 54:769-772.

SIEGEL, SANFORD M. 1967. Microbiology of saturated salt solutions and other harsh environments. II. Ribonucleotide dependency in the growth of a salt-habituated Penicillium notatum in salt-free nutrient media. Plant Physiology 42:201-204. III. Growth of salt-tolerant Penicillium notatum in boron-rich media. Plant Physiology 42: 1215-1218.

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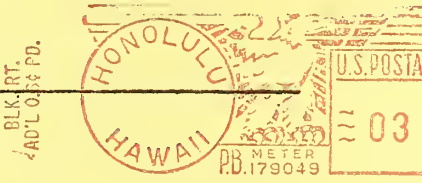

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